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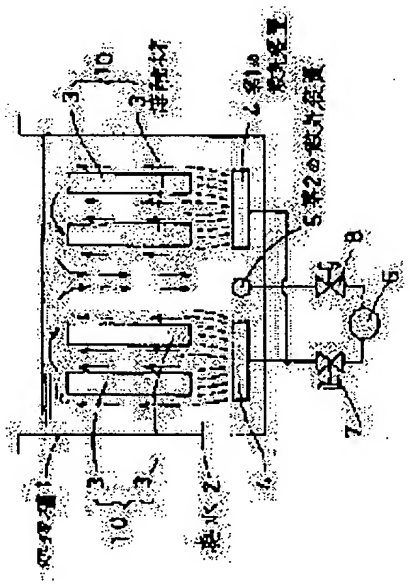
(54) BATCH-WISE WASTE WATER TREATING DEVICE

(57)Abstract:

PURPOSE: To prevent the enlargement of the microorganism layers on contact materials by improving the aeration system of the batch-wise waste water treating device packed with the contact materials 3 in a treating tank 1.

CONSTITUTION: A 1st air diffuser 4 which is so constituted that the ascending flow by bubbles for aeration comes into contact with the contact materials 3 and a 2nd air diffuser 5 which is so constituted that the descending flow by the bubble for aeration comes into contact with the contact materials 3 are provided. The air diffuser 4 and the air diffuser 5 are alternately operated. Since the ascending flow and the descending flow come into contact alternately with the contact materials 3, the surfaces of the contact materials 3 are washed and the aerobic and anaerobic microorganisms coexisting on the contact materials 3 affect each other to adequately suppress the activity. The dislodgment of the microorganism layers by the enlargement is, therefore, prevented.



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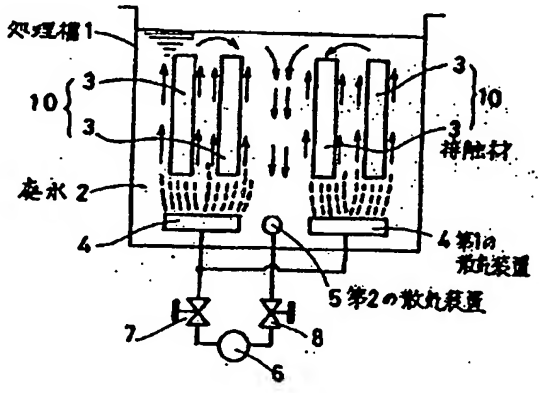
(54)【発明の名称】　回分式廃水処理装置

(57)【要約】

【目的】　処理槽１に接触材３を充填した回分式廃水処理装置において、曝気方式を改善して接触材上の微生物層の肥大化を防止する。

【構成】　曝気用気泡による上昇流が接触材３に当たるようにした第１の散気装置４と、曝気用気泡によって生ずる下降流が接触材３に当たるようにした第２の散気装置５を設け、散気装置４と散気装置５を交互に作動させる。

【効果】　接触材３に上昇流と下降流が交互に当たるために接触材３の表面が洗浄され、また接触材３上に混在する好気性と嫌気性の微生物が互いに影響を及ぼして活性が適度に抑えられる。このため、肥大化による微生物層の脱落が防止される。



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【特許請求の範囲】

【請求項1】　処理槽に接触材を充填した回分式廃水処理装置であって、接触材に上昇流が当たるように配置された第1の散気手段と、接触材に下降流が当たるように配置された第2の散気手段、とを設け、第1の散気手段と第2の散気手段を交互に作動させるようにしたことを特徴とする回分式廃水処理装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、接触材を用いる回分式廃水処理装置の改良に関するものである。

【0002】

【従来の技術】回分式廃水処理装置には、微生物担持用の接触材を処理槽内に充填したものがある。この接触材は嫌気性の微生物と好気性の微生物を接触材上に混在繁殖させることにより微生物の活性を適度に抑え、微生物の過剰繁殖を防いで多量な活性汚泥の発生を防止すると共に、装置の処理性能を向上することを目的としている（例えば、本出願人の出願に係る特願平2-86176号参照）。また処理槽内には散気手段が設けられており、曝気工程では散気手段から微細な気泡を放出して反応を促進することが行われている。

【0003】

【発明が解決しようとする課題】このように接触材を用いた装置においては、曝気工程が繰り返されると接触材に付着した微生物の層が次第に厚くなり、内部の嫌気性膜が増加して反応を遅延させるという問題が生ずる。また厚くなった微生物層が脱落しやすくなり、脱落すると処理能力が低下するので面倒な交換が必要となるという問題点もあり、これを防ぐために適当な周期で洗浄を行う等の予防処置を実施する必要があった。

【0004】この発明はこのような点に着目し、曝気方式の改善によって接触材上の微生物層の肥大化を防止することを目的としてなされたものである。

【0005】

【課題を解決するための手段】上記の目的を達成するために、この発明の回分式廃水処理装置は、接触材に上昇流が当たるように配置された第1の散気手段と、接触材に下降流が当たるように配置された第2の散気手段、とを設け、第1の散気手段と第2の散気手段を交互に作動させるようにしている。

【0006】

【作用】第1の散気手段と第2の散気手段を交互に作動させると、接触材に上昇流と下降流が交互に当たるので接触材が洗浄され、好気性か嫌気性のいずれかの微生物が一方的に増加することがなくなり、微生物層が脱落するほど過度に肥大化することも防止される。

【0007】

【実施例】図1及び図2はこの発明の装置の一実施例の概略断面図であり、1は処理槽、2は廃水、3は複数個

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の接触材、4は第1の散気装置、5は第2の散気装置、6はブロワー等の給気用高圧空気源であって、散気装置4は電磁弁7を介して、また散気装置5は電磁弁8を介してそれぞれ高圧空気源6に接続されている。各接触材3は例えばフロートと繊維質材料からなる微生物担持部とが一体となった構造のもので、少なくとも曝気工程では廃水2内に水没する状態で設けられており、この実施例では繊維質材料からなる微生物担持部の充填率が10％乃至30％程度の数値になるようにその寸法が選定されている。また、接触材3は複数個が比較的密に配置されて接触材群10を構成し、各接触材群10の間の間隔は少し広くなっている。

【0008】散気装置4は接触材群10の下部に配置されており、散気装置5は接触材3が配置されていない部分、すなわち各接触材群10の間の下部に配置されている。また、電磁弁7及び8は図示しない制御部によって数分乃至数十分程度の周期で交互にオンされるようになっており、これに従って散気装置4と散気装置5から交互に曝気用気泡が放出される。なお、接触材3の支持構造、廃水供給管、上澄水引き抜き装置等の他の構造物は図示を省略してある。

【0009】実施例の装置は上述のように構成されており、散気装置4の作動時には、図1に矢印で示すように散気装置4から放出された曝気用気泡によって生じた上昇流が接触材3に当たりながら上昇し、下降流が各接触材群10の間を通って下降する。また散気装置5の作動時には、図2に矢印で示すように散気装置5から放出された曝気用気泡による上昇流は接触材3に当たらずに上昇し、下降流が接触材3に当たりながら下降する。

【0010】このように、接触材3は上昇流と下降流が交互に当たってその表面が洗浄される結果となり、また酸素を多量に含む上昇流と酸素量の比較的少ない下降流が交互に当たるため、好気性と嫌気性の微生物が接触材3上に混在して繁殖し、互いに影響を及ぼして活性が適度に抑えられる。このため、脱落するほど微生物層が肥大化することがなく、また好気性か嫌気性のいずれかの微生物が一方的に増加することもなくなるのである。

【0011】ここで、この実施例では接触材3の充填率を10％乃至30％程度に選定している。なお、接触材の充填率とは処理槽内の廃水容積に対する接触材の容積比を意味している。一般に、接触材の量が少ない場合には好気性の反応が進み、接触材の量が多いと微生物の酸素との接触が少なくなって嫌気状態となることが知られているが、生物化学的酸素要求量（BOD）を低下させるには好気性の反応が必要であり、接触材の量が少ない場合に好気性反応が促進されるので、BOD対策としては接触材の充填率を低く抑えることが望ましい。一方、全窒素（T－N）を低下させるには、好気状態での硝化反応と嫌気状態での脱窒反応という相反する反応をバランスさせる必要があり、T－N対策としては接触材の充填率

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をある程度高くすることが望ましい。

【0012】図3は本発明者がこの点について研究した結果の代表的な例を示したものである。すなわち、グルコース、ポリペプトン、燐酸カリウムからなる合成廃水を用いて、1日1サイクルの回分方式により接触材の充填率を変化させて、充填率とBOD及びT－Nの低下率（あるいは除去率）の関係を調査したところ、図のように、BODは充填率が0から20％程度までは最高の値を示し、20％を超えると次第に低下する傾向が認められた。またT－Nについては充填率が0％では極めて低く、20％前後までは上昇傾向を示したが、20％前後を超えると次第に低下する傾向が認められた。このことは、充填率が20％付近を境としてこれより低い場合には嫌気性反応が不十分となり、これより高いと好気性反応が不十分となることを示し、T－Nについては20％付近で好気性と嫌気性の反応のバランスが良好で最も除去率が高くなることを示していると考えられるのである。

【0013】従って、接触材の充填率を10％乃至30％程度に、好ましくは15％乃至25％程度に選定することにより、BODとT－Nの両方について良好な処理結果が得られるのであり、上記の散気方式の改善との相乗効果もあって良好な処理反応が行われ、BODとT－N値を十分に低下させることが可能であった。なお、処理条件や廃水の種類によって接触材の充填率の最適な数値は変動するので、図3に示したように10％乃至30％よりやや広い範囲が選定可能な範囲と考えられる。

【0014】

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【発明の効果】以上の説明から明らかなように、この発明の回分式廃水処理装置は、散気手段による上昇流と下降流が接触材に交互に当たるようにしているので、微生物層の肥大化が防止されてその厚さが自動的に適正値に制御され、肥大化することによる微生物層の脱落もなくなるので、洗浄等が不要となって管理が容易となるのである。また、実施例のように接触材の充填率を10％乃至30％程度に選定することにより、窒素除去に必要な好気性と嫌気性の反応のバランスが良好となり、窒素除去率を向上することも可能となる。

【図面の簡単な説明】

【図1】この発明の一実施例の構成を示す概略断面図である。

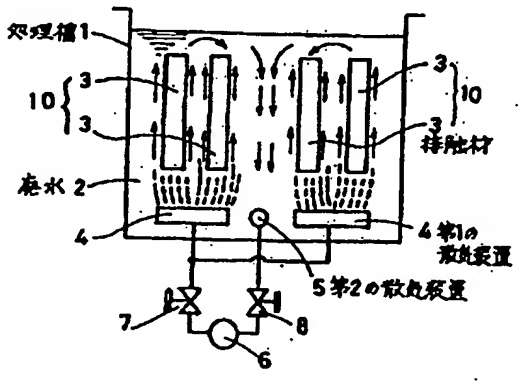
【図2】同じく実施例の概略断面図である。

【図3】接触材の充填率と生物化学的酸素要求量（BOD）及び全窒素（T－N）の低下率の関係を示したグラフである。

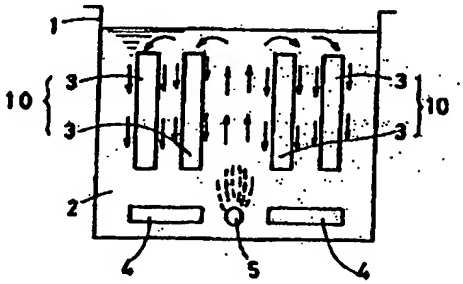
【符号の説明】

1　処理槽
2　廃水
3　接触材
4　第1の散気装置
5　第2の散気装置
6　高圧空気源
7　電磁弁
8　電磁弁
10　接触材群

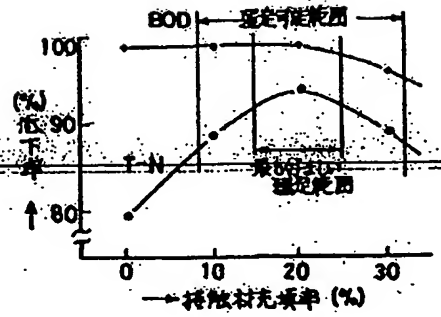
【図1】



【図2】



【図3】



Context Communications

Certification

I, Alex Kent, a professional translator, hereby certify that the attached English document, Publication of an Unexamined Patent Application JP4-250898, is a true and faithful translation from the Japanese language.

By Alex Kent 9/23/04

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(54) Title of Invention: BATCH-TYPE WASTEWATER TREATMENT DEVICE

(57) Abstract

Purpose

To prevent the enlargement of the microorganism layers on contact material by improving the aeration system in a batch-type wastewater treating device packed with contact material 3 in a treatment tank 1.

Constitution

A 1st air diffuser device 4 which is so constituted that the ascending flow by the aeration bubbles comes into contact with the contact material 3, and a 2nd air diffuser device 5 which is so constituted that the descending flow by the aeration bubbles comes into contact with the contact material 3 are provided. The air diffuser device 4 and the air diffuser device 5 are alternately operated.

Effect

The surfaces of the contact material 3 are washed and the aerobic and anaerobic microorganisms admixed with the contact material 3 and affect each other to sufficiently suppress their microorganism activity since the ascending and descending flows come into contact alternately with the contact material 3. Thus, dislodging of the microorganism layers due to enlargement is prevented.

[figure callouts]

Treatment Tank	1
Filtrate	2
Contact Material	3
1st Air Diffuser Device	4
2nd Air Diffuser Device	5

Claims

Claim 1

A batch-type wastewater treatment device in which the batch-type wastewater treatment device has a treatment tank filled with contact material, a 1st air diffuser means disposed so that the ascending flow comes into contact with the contact material, a 2nd air diffuser means disposed so that the descending flow comes into contact with the contact material, and so that the first and second air diffuser means operate alternately.

Detailed Description of the Invention

0001

Industrial Field of Use

This invention relates to improved batch-type wastewater treatment devices that use contact material.

0002

Prior Art

Batch-type wastewater treatment devices have treatment tanks that are filled with contact material that retains microorganisms. By mixing and propagating anaerobic and aerobic microorganisms on this contact material, the contact material controls the concentration of active microorganisms, preventing the excessive propagation of microorganisms, thereby preventing the creation of large quantities of activated sludge. At the same time, a goal of the contact material is to increase the treatment performance of the device. (See, for example, the present applicant's patent filing 2-86176.) Also, an air diffuser means is provided in the treatment tank, and fine bubbles are released during the bubbling phase by the air diffuser means to promote the reaction.

0003

Problems the Invention is Intended to Resolve

In these types of devices that use contact material, the repetition of the bubbling cycle results in the buildup of microorganism layers on the contact material, with the result that the anaerobic layer increases inside the contact material, thereby retarding the reaction. Moreover, the thickened microorganism layers are apt to become dislodged, and when they are dislodged, the device's treatment performance declines and troublesome replacement becomes necessary. Preventive measures such as periodic washing have been required in order to prevent these problems.

0004

In light of these issues, the present invention is intended to prevent the enlargement of the microorganism layer on the contact material by making improvements to the bubbling method.

0005

Means of Solving the Problems

In order to achieve this objective, the batch-type wastewater treatment device of the present invention is provided with a 1st air diffuser means disposed so that the ascending flow makes contact with the contact material, a 2nd air diffuser means disposed so that the descending flow makes contact with the contact material, and so that the first and second air diffuser means are operated alternately.

0006

Operation of the Invention

When the first and second air diffuser means are operated alternately, the contact material is washed because the ascending and descending flows alternately make contact with the contact material so that neither the aerobic nor anaerobic microorgan-

isms increase in quantity, and the microorganism layer does not become so enlarged that the layer would become dislodged.

0007

Embodiments

Figures 1 and 2 show simplified cross sections of an embodiment of the device of this invention. 1 is the treatment tank, 2 is the wastewater, 3 is a plurality of contact material, 4 is the 1st air diffuser device, 5 is the 2nd air diffuser device, 6 is a blower or other high pressure air supply. The air diffuser devices 4 and 5 are connected to the high pressure air supply 6 via solenoid valves 7 and 8, respectively. Since each of the contact materials 3 is unitized with a microorganism holding part which may, for example, be comprised of float [sic] and fibrous material, so that at least during the aeration cycle, it is submerged in the wastewater 2. In this embodiment, the filling ratio of the microorganism holding part, which may be comprised of fibrous material, is limited by its dimensions so that the filling rate is approximately from 10% to 30%. Moreover, the contact material 3 is comprised of multiple elements disposed in contact material masses 10 which are disposed relatively densely, and the gaps between each contact material mass 10 become somewhat wider.

0008

The air diffuser device 4 is disposed beneath the contact material mass 10, and the air diffuser device 5 is disposed so that it is in locations where the contact material 3 is not disposed, which is to say that it is disposed so it is beneath the spaces between each of the contact material masses 10. Further, the solenoid valves 7 and 8 are actuated alternately in cycles of several minutes to several tens of minutes by the control part that is not shown, thereby alternating the release of aeration bubbles from the air diffuser devices 4 and 5. Note that the contact material 3 support structure, wastewater supply pipe, purified water takeoff device and other structural parts are omitted from the drawings.

0009

In the embodiment device constituted as described above, an ascending flow that is created by the aeration bubbles released from the diffuser device 4 in the direction shown by the arrow in Figure 1 when the air diffuser device 4 operates, ascends while making contact with the contact material 3, and the descending flow descends, passing in between each of the contact material masses 10. Moreover, when the air diffuser device 5 operates, the ascending flow caused by the aeration bubbles released from the air diffuser device 5 in the direction of the arrow in Figure 2 ascends without coming into contact with the contact material 3, and the descending flow descends while coming into contact with the contact material 3.

0010

In this way, the ascending and descending flows alternately contact the contact material 3, and the surface of the contact material is washed. Also, as a result of the alternating contact made by the oxygen-rich ascending flow and the relatively oxygen-poor descending flow, the aerobic and anaerobic microorganisms combine and propagate on the contact material 3, and their activation is controlled to an appropriate level. Therefore, the microorganism layer does not grow to the point that it would become dislodged, and there is no lopsided increase in either aerobic or anaerobic microorganisms.

0011

In this embodiment, a contact material 3 filling rate of about 10% to 30% has been selected. Here, the contact material filling rate means the volume of the filling material relative to the wastewater volume in the treatment tank. Typically, it is known that aerobic reactions are promoted when the quantity of contact material is small, and conversely that when there is a large quantity of contact material there is little contact between the oxygen from the microorganisms and the contact material, and conditions become anaerobic. However, aerobic reactions are necessary to reduce the biochemical oxygen demand (BOD), and since aerobic reactions are promoted when there is little contact material, it is desirable to minimize the contact material filling rate as a BOD countermeasure. On the other hand, in order to reduce total nitrogen (T–N), it is necessary to balance reciprocally the oxidizing reactions in aerobic conditions and the denitrifying reactions in anaerobic conditions, so as a T–N countermeasure, it is desirable to increase the contact material filling rate to a certain extent.

0012

In this connection, Figure 3 shows a typical example of research results obtained by the inventors. Compound wastewater consisting of glucose, polypeptone, and potassium phosphate was used. Using the batch method, the filling rate of the contact material was changed at a cycle of once per day. Our study of the relationship between the BOD and T–N reduction rate (or the removal rate) and the filling rate indicated that when the filling rate is between 0% and 20%, the highest levels of BOD are obtained. When the filling rate exceeds 20%, BOD immediately decreases. Moreover, T–N is extremely low when the filling rate is 0%, and shows a tendency to increase up to a filling rate of approximately 20%. However, when the filling rate exceeds approximately 20%, T–N immediately begins to decrease. This indicates that with approximately 20% as the boundary, when the filling rate is low, anaerobic reactions are insufficient, and when it exceeds 20%, aerobic reactions are insufficient. In terms of T–N, we believe that filling rates in the vicinity of 20% create the optimal balance between the aerobic and anaerobic reactions with the highest removal rate.

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Therefore, by selecting filling rates for the contact material of from 10% to 30%, and preferably from approximately 15% to 25%, good treatment results can be obtained for both BOD and T–N. This is also an effective method for improving the above-described air diffusion method in order to obtain good treatment reactions that enable sufficient reductions in both BOD and T–N levels. The filling rate of the contact material can be varied according to the treatment conditions and the type of waste water, so we believe it is possible to select from a range that is somewhat broader than the 10% to 30% indicated in Figure 3.

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Effect of the Invention

As described above, in the batch-type wastewater treatment device of this invention, the enlargement of the microorganism layer is prevented and its thickness of this layer is controlled automatically to an appropriate degree because the air diffuser means is designed so that the ascending and descending flows alternately make contact with the contact material. Moreover, since the microorganism layer is not dislodged due to enlargement, maintenance is simplified because there is no need for washing. Furthermore, by selecting a contact material

filling rate of approximately 10% to 30% as in the embodiment, an excellent balance between the aerobic and anaerobic reactions needed for denitrification can be obtained, and it is possible to increase the denitrification rate.

Brief Description of the Drawings

Figure 1 Simplified cross sectional view showing the constitution of an embodiment of this invention

Figure 2 Simplified cross sectional view showing the constitution of an embodiment of this invention

Symbols

1	Treatment tank
2	Wastewater
3	Contact material
4	1st air diffuser device
5	2nd air diffuser device
6	High pressure air supply
7	Solenoid valve
8	Solenoid valve
10	Contact material mass

Figure 3

y	Rate of reduction (%)
x	Contact material filling rate (%)
	Possible selection range
	Ideal selection range